ABSTRACT OF THE DISCLOSURE

A system for detecting and classifying small amounts of explosives and other controlled substances while rejecting confounders, including a source/detector array formed of a plurality of sources and a plurality of detectors, a signal processor coupled to the source/detector array for processing data received from the detectors, a classifier coupled to the signal processor for classifying data received from the signal processor according to a plurality of algorithms, a maximal rejection classifier coupled to the classifier; and a declarative decision module coupled to the maximal rejection classifier for rendering an accurate decision regarding the contents of the object is provided. The apparatus includes an enclosure, a shield layer disposed within the enclosure, a cavity disposed within the shield layer, a plurality of neutron sources and a detection array disposed within the cavity, and a transport mechanism for moving objects through the cavity past the sources and detection array. The cavity has one or more turns which preclude a straight line trajectory through the cavity. The shield layer is water-filled to prevent stray radiation from exiting the enclosure. The use of multiple lower power neutron sources and the particular geometry of the enclosure provide a compact, relatively lightweight explosive detection system which is practical for use in airports and other public locations.